Date: Thu,  8 Apr 93 04:30:02 PDT
From: Packet-Radio Mailing List and Newsgroup <packet-radio@ucsd.edu>
Errors-To: Packet-Radio-Errors@UCSD.Edu
Reply-To: Packet-Radio@UCSD.Edu
Precedence: Bulk
Subject: Packet-Radio Digest V93 #92
To: packet-radio

Packet-Radio Digest         Thu,  8 Apr 93       Volume 93 : Issue   92

Today's Topics:

A New DSP
Baycom to IC2WA connections wanted.
Rich Man's Packet ... :-) (3 msgs)

Send Replies or notes for publication to: <Packet-Radio@UCSD.Edu>
Send subscription requests to: <Packet-Radio-REQUEST@UCSD.Edu>
Problems you can't solve otherwise to brian@ucsd.edu.

Archives of past issues of the Packet-Radio Digest are available
(by FTP only) from UCSD.Edu in directory "mailarchives/packet-radio".



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Date: Wed, 7 Apr 1993 12:02:34 GMT
From: mvb.saic.com!unogate!news.service.uci.edu!usc!wupost!uwm.edu!linac!tellab5!
jwa@network.UCSD.EDU
Subject: A New DSP
To: packet-radio@ucsd.edu

In case your interested in DSP's Here is an article that
I worte, that appeared in the January 92 issue of QEX

## A NEW DSP FOR PACKET

In the early 70's synthesized radios became available to the Amateur
market. However, the technology wasn't new.  The Military used
synthesized radios since the early 60's.  The computer and micro-
processor became popular in the mid 70's and that got us into the
packet age in the 80's.  But we all know that electronic computers
where around for about 25 years.  In the 90's, it appears that
the hottest item is the DSP.   Again the technology has been around
for about twenty years and it's finally making it's way into the

Ham Radio market. As with any new technology the reason for it's availablity is cost reduction due to large scale integration.

Manufactures of Ham gear are including DSP's in their products and there is a little skepticism about the price! Is it really worth the three or four hundred more dollars just to clean up a few harmonics in my signal? How can it improve packet reception on HF? Will I have sell my old gear ? After being involved in a DSP development project I beleive that the DSP can make a significant improvement in HF packet and RTTY reception and it's well worth the investment.

For the about the past 7 years the DSP has been reduced to a single chip about the size of the microprocessor in your computer. In fact, the DSP is nothing more than a microprocessor. A very special processor that can handle mathematical computations at lightening speeds. The DSP that I'm involved with runs on a 40 mHz clock and Texas Instruments now has a version that runs at 50 mHz.

Like any new technology the price is always high at first. But when newer chips are developed, the old ones drop in price. That's true with the TexasInstruments TMS320C25 DSP. When it was first introduced about two years ago, it cost about $125.00. Now you can get them for about $25.00 in single quantities. That's why we choose the TI DSP for our project.

## THE DSP25 BLOCK DIAGRAM/ DESCRIPTION

The DSP25 is an inexpensive Digital Signal Processor that plugs into the 8 bit expansion port of an IBM PC or IBM compatible computer. It provides audio connections to a receiver or transceiver for operating digital modes in the HF or VHF bands. It also has an 8 bit TTL input/output port for interfacing to a Packet or all mode TNC. There is also a 16 bit I/O port on a 32 pin header connector to interface to a baby board which can contain a dual parallel DAC for connecting an X/Y tuning scope or other ancillary devices.

The DSP can replace the TNC's analog filters, fsk demodulator or tone encoder. It can also be used as a digital audio filter for CW mode, a digital signal analyzer and a digital oscilloscope within the audio range. FSK signals are processed and converted to a TTL level to the 8 bit I/O port or they can be converted to an RS232 level and transferred to the audio out port. The FSK signal can also be regenerated

(eliminating 100% of the noise) and interfaced to a TNC's audio input (A to A connection).

The audio to audio connection simplifies the "hook up" and still provides the advantage of improved error performance. The DSP25 consist of four basic circuits, the PC Host interface, a Texas Instruments 40 mHz TMS320C25 Digital Signal Processor chip, 8k words of RAM, and a Texas Instruments TLC32044C Analog Interface chip. It's constructed on an IBM PC/XT compatible 10" expansion PC board and the analog/digital connections are accessible on the rear bracket/panel.

## THE HOST INTERFACE

The PC Host interface decodes the PC address, passes data from the 8 bit PC bus via the buffers and latches to the 16 bit DSP bus. It provides handshaking between the PC and DSP, and by placing the DSP chip in hold mode, DMA (direct memory access) from the 8k RAM to the PC I/O port is possible. There is also a sequential address decoder which allows the PC to access the ram in two 4k word pages for loading binary files from a floppy or hard drive and for providing direct memory access for large data transfers.

## THE ANALOG INTERFACE

The Analog Interface chip converts the audio or linear signal to digital data. It transmits the data on a receive serial communications port to the DSP chip. The DSP processes the data and returns it to the A/I chip via the transmit serial port. The A/I can be programmed for pass through mode and there are 3 gain steps available. The DSP pcb has filter chokes to reduce EMI interference to the receiver and a quad op-amp is used to boost the signal in either direction on the analog port.

## SOFTWARE

The software for the DSP is still under development but we do have two working modems that are di-no-mite! The PKT modems are for packet and test results so far are very promising. We decided to work on the 300 baud modem first because the problems on H.F is causing the packeteers the most trouble. We have ran test using 45 baud RTTY and the PKT modem was very promising but the filters need to be retuned for the lower baud rate.

Here's a brief description

# PKT SERIES MODEMS

The PKT series modem is computer software that is designed to operate on the PC compatible DSP25 Digital Signal Processor for 300 baud Packet Radio and ASCII modes. They where computer simulated and tested to obtain maximum noise rejection and the best possible error rate performance for Amateur and SWL applications.

Except for the analog interface and IO port, the block diagram on the next page is hypothetical and does not reflect an actual working circuit or electronic diagram. The modem filters and functional blocks are embedded in the software. Several functions can be changed or modified using the "Control Panel" software that is provided with each modem.

## The Analog Input

The audio signal from an H.F. receiver/transceiver enters the analog interface chip and is converted to data. The data is sent to the DS Processor and it performs the mathematical functions (indicated by the blocks).

## Pre-filtering

The first function is a sixth order Chebyshev bandpass filter. The filter reduces noise and improves the performance of the A.G.C. block. The data is then processed by the limiter which sets a maximum numeric limit. The data is then passed to the second sixth order filter which further reduces noise and pre-filters the signal for the frequency detection blocks.

## FSK Decoding (The Frequency Detection Block)

Two fourth order Bowtie tone filters are separately tuned at the mark and space frequencies. The filters separate the energy in FSK signal. The signal or data is then rectified by generating positive numbers from the mark filter and negative numbers from space filter.

## Post filtering

The numbers are further processed using a lowpass filter. It removes the high frequency components in the serial bit stream and further improves the signal to noise performance. Other mathematical routines include a threshold detector and hysteresis. The data is then passed as a serial bit stream to the I/O port or other

functions.  The modem also includes a carrier detect, an FSK oscillator and control logic which allows the user to setup various parameters using the Control Panel software.

## OTHER PKTA/PKTB MODEM FUNCTIONS

### Modem Parameters

The Carrier detect routine keys the FSK oscillator on and off as well as providing an output via the I/O port on DIN1. It also (bydefault) sets the AI chip in a loopback mode when no signal is detected. This allows the user to monitor the channel via an external speaker/ amplifier during quiet channel conditions. The channel can also be monitored via the first and second prefilter which reduces the audio bandwidth and noise.  The first and second perfilters can be used as a CW filter.

### Audio to Audio connection

A parameter can be set which allows the user select the FSK oscillator only.  This function provides an interface from the DSP to an external TNC's audio input and it regenerates the received signal with noise a free FSK generator.  The TNC decodes the FSK using the improved signal to noise performance of the DSP.  During a quite channel (no packets) the FSK oscillator will be disabled, then the TNC can key the transmitter  using the normal connection to the XMT key line for packet operation.  If the monitor option was enabled and the regenerator disabled because no carrier was detected, the received channel can be monitored via the DSP using the full breakin capabilities of the software.  The user can also use the audio oscillator to provide audio FSK to a transmitter,s "mike" input. Because of the XMTR's low input level, a resistor divider network is needed to drop the audio level to the XMT

### Audio to Digital connection

The Audio input to the DSP connects to the receiver's speaker or aux audio output.  It can handle levels as high as 1 volts p to p however, overdriving of the DSP can damage it or cause poor error performance.  The typical level should be about .3 to .7 volts RMS.

The  TNC's TTL level serial data input is connected to the DSP's DOUT0 output.  The FSK is demodulated by the DSP and the serial

bit stream is sent to DOUT0.  The TNC decodes packets or RTTY using the improved signal to noise performance of the DSP.  DOUT1 is the inverted serial output.

The TNC's TTL level serial data output is connected to the DSP's I/O port DIN0.  During transmit, the data from the TNC is switched to the DSP's FSK oscillator.  The DSP,s oscillator is connected to the transmitter's audio input using an attenuater network. This allows the user to implement  the DSP's continuous phase, frequency shift oscillator .

DOUT 2 is a TTL level Carrier detect. It can be connected to a TNC to be used as an external carrier detect.

DOUT3 is a XMT key line and can be connected to some TNC's for keying the transmitter.  This output is a TTL level output and requires a special circuit for transmitter keying.

TEST RESULTS

I conducted a test using two PK232's and an Icom R71 common receiver on 20 meters (the TNC's where in monitor mode).  One PK232 was connected to the DSP card Via the external modem input on the rear apron.  A modem formerly called  P3020 (now  PKTB) was loaded into the DSP from an IBM PC.  The other "barefoot" TNC was connected to a Compaq Deskpro and both computers  copied the text to a capture buffer.  The time/date on both TNC's where set within a few  seconds. A Radio Shack counter module #277-302 was connected to the carrier detect L.E.D. circuit.  The threshold was adjusted for average strength packets.

HERE ARE MY RESULTS

Test #1

> Both TNC's didn't copy very many packets.  The band condition at that time was poor.

Test #2;

> The band condition improved and 182 packets where counted. The PK232 copied 47 and the DSP/PK232 copied 116.

Test #3

Only 3 packets where copied on the barefoot PK232, on the other hand, the DSP copied 82 out of 202.

Test #4

There where 78 packets out of 487 for the PK232 and the DSP/PK232 copied 162.

As you can see the DSP, depending on the band conditions, did a much better job. The DSP makes a better FSK decoder because the filters where designed and simulated for a specific application (packet radio). If the circuit in the PK232 was simulated on a DSP the two units probably would have performed the same.

COPYING CW

The upgraded version of the PKT modems have a feature that allows the user to monitor the receivers audio through the FSK decoder's pre-filters. I used this setup to copy CW and weak cariers on 20 meters. I was able to pull out signals that where almost in-audible (about equal with the noise level). The second prefilter was selected. The first prefilter responce was about equal to a 4 pole BP chebychev. When I tuned to a stronger signal, I tuned across the filters bandpass (about 400 hz) in noticed as I reach the lower or upper limit of the passband, the signal dissapeared as if the filter had infinate stopband response.

Conclusion

The DSP is a newcomer in the HF digital world. More software and better modems that can handle the hostile HF environment are needed. Because the DSP is versitle modems can be developed, simulated and easly loaded. It will allow developers to try other modulation schemes that can greatly enhance digital communications on H.F.

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Jack Albert Fellow Radio Buff
Tele (708) 512-7854
Tellabs, Inc. FAX (708) 852-7346
4951 Indiana Ave. jwa@tellabs.com
Lisle, IL
60532

Do you have a certain itch that's so private,

you'll only discuss it with your physician?

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Date: 8 Apr 93 11:28:16 +1200
From: usc!wupost!waikato.ac.nz!barhodes@network.UCSD.EDU
Subject: Baycom to IC2WA connections wanted.
To: packet-radio@ucsd.edu

Could someone email me the connections for hooking up a icom IC2WA
to the baycom packit modem.
I have no documentation on this unit.
I anyone has interfaced the baycom unit to the above set, I would appreciate
some help.
cheeres.
Bruce Rhodes ZL1UBR

email -IN%"BARHODES@WAIKATO.AC.NZ"
University Of Waikato
Hamilton
New Zealand

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Date: 7 Apr 93 23:52:38 GMT
From: sdd.hp.com!saimiri.primate.wisc.edu!usenet.coe.montana.edu!ogicse!
usenet.ee.pdx.edu!fastrac.llnl.gov!wsrcc.com!wetware!spunky.RedBrick.COM!psinntp!
psinntp!bacon!jordan@network.UCSD.EDU
Subject: Rich Man's Packet ... :-)
To: packet-radio@ucsd.edu

Gary Coffman <gary@ke4zv.UUCP> writes:

> Well we're still poking along at 56 kb on 222 or 440 MHz. I
> don't know anyone actually running packet in the car with one
> of these systems.

What's required to run one of these systems?  56kb would be fine for
the application I'm thinking of.

> I know a couple of fellows who run 1200 baud packet from their
> cars, but typing and driving really don't mix.

They need to find someone else to drive :-)

/jordan

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Date: 8 Apr 1993 05:43:26 GMT
From: usc!howland.reston.ans.net!agate!uclink.berkeley.edu!
acollins@network.UCSD.EDU
Subject: Rich Man's Packet ... :-)
To: packet-radio@ucsd.edu

In article <6977@bacon.IMSI.COM> jordan@IMSI.COM (Jordan Hayes) writes:
>Gary Coffman <gary@ke4zv.UUCP> writes:
>
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>    don't know anyone actually running packet in the car with one
>    of these systems.
>
>What's required to run one of these systems?  56kb would be fine for
>the application I'm thinking of.
>

What exactly is the source for the 50kbaud modems?  I have looked
some, but I haven't been able to find much info.  What kind of
setup (i.e. modem, radio, TNC) is standard?  What hardware would
you recommend?

Andy Collins, KC6YEY
acollins@uclink.berkeley.edu

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Date: Thu, 8 Apr 1993 07:51:40 GMT
From: usc!howland.reston.ans.net!gatech!kd4nc!ke4zv!gary@network.UCSD.EDU
Subject: Rich Man's Packet ... : -)
To: packet-radio@ucsd.edu

In article <6977@bacon.IMSI.COM> jordan@IMSI.COM (Jordan Hayes) writes:
>Gary Coffman <gary@ke4zv.UUCP> writes:
>
>    Well we're still poking along at 56 kb on 222 or 440 MHz. I
>    don't know anyone actually running packet in the car with one
>    of these systems.
>
>What's required to run one of these systems?  56kb would be fine for
>the application I'm thinking of.

You need a GRAPES 56 kb RF modem and a transverter. The modem is an
RF design using MSK that outputs on 29 MHz. You use a transverter
to kick that to the UHF band of choice. Occupied bandwidth at 56 kb
is 70 kHz. There are 100 kHz wide channels on 222 and 440 in the
bandplan for these modems. You'll also need a PAD of some sort.

GRAPES will give you modification instuctions and a firmware
image for the TNC2, or you can use an internal card in a PC.
The Ottawa group sells the PI card, and Gracilis sells their
Packettwin card. We recomend this method as the cleanest way to
go. As far as I know, everyone is using one of the KA9Q NOS
varients with these modems since drivers are available for
the cards. Note that the MAC serial port can drive the modem
directly, it's an 8530.

Email if you want more info on the GRAPES modem.

Gary

--
Gary Coffman KE4ZV          |    You make it,     | gatech!wa4mei!ke4zv!gary
Destructive Testing Systems |    we break it.     | uunet!rsiatl!ke4zv!gary
534 Shannon Way             |    Guaranteed!      | emory!kd4nc!ke4zv!gary
Lawrenceville, GA 30244     |                     |

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End of Packet-Radio Digest V93 #92
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